

TwinBrain Newsletter

December 2022

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A word from the Principal Investigator

We are entering into the third and final year of the TwinBrain project. At this point, we are pleased to share with you what we have been doing over the last 12 months.

To implement theMoBI approach in clinical trials, we have been undertaking numerous testings to setup the MoBI approach in Slovenian Mobile Brain/Body Imaging Lab. At this point, we are happy to announce that the TwinBrain clinical trial is running and are pleased to be able to confirm that the MoBI approach is feasible in clinical settings with early-diagnosed Parkinson's disease patients. There are currently three groups of researchers dealing with complex analyses of multicomponent data and preparing first outcomes of whole-body kinematics, hdEEG and hdEMG. Our final aim now is to merge this data and get a holistic overview of neuromuscular performance of such patients.

In addition to the tests and clinical study, we have made sure that all TwinBrain events were well on track also in the past year. The TwinBrain Summer School 2.0, TwinBrain Workshop 2.0 and several in-house transfers of knowledge, which were led by staff from project offices of all partner institutions were all implemented successfully and received positive feedback. At this point, I would like to thank all project partners for their active participation in activities and support in their implementation.

Looking ahead to 2023, I am excited about the upcoming activities and look forward to welcoming many of you to the next edition of the TwinBrain Summer School, workshop, roundtable and much more.

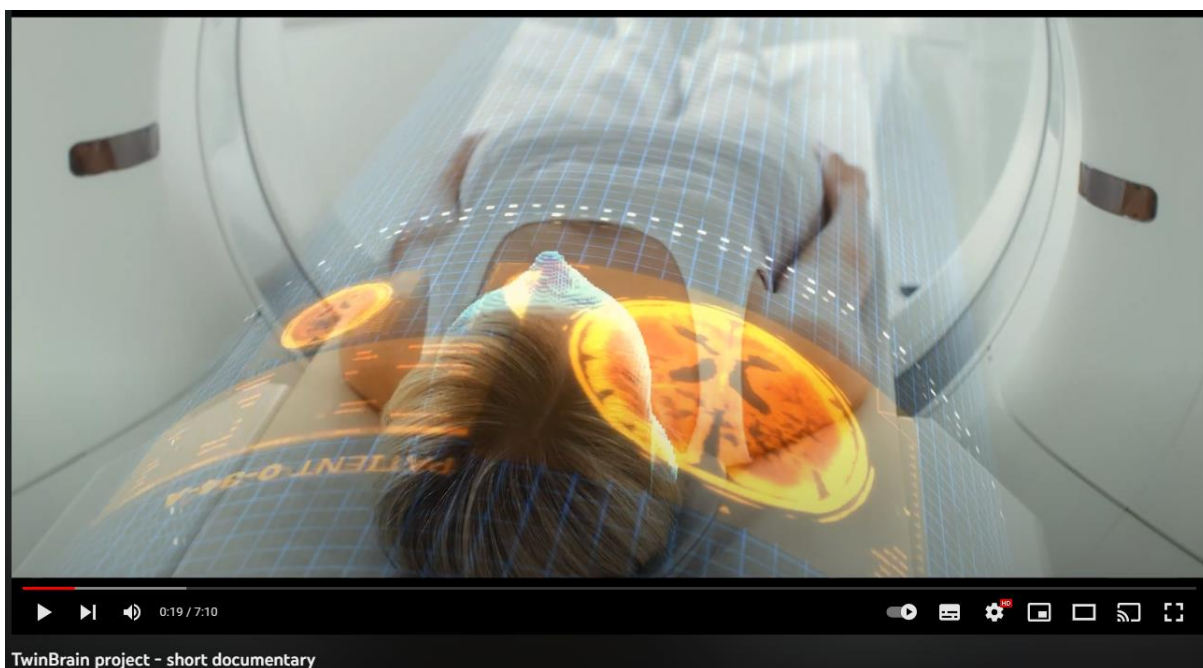
May the upcoming year be full of success and new discoveries. Happy 2023!

Uroš Marušič

The TwinBrain documentary

Check out the documentary film that the TwinBrain consortium recorded to showcase possibilities of MoBI approach in clinical settings.

<https://youtu.be/Vm42f2cIJwO>

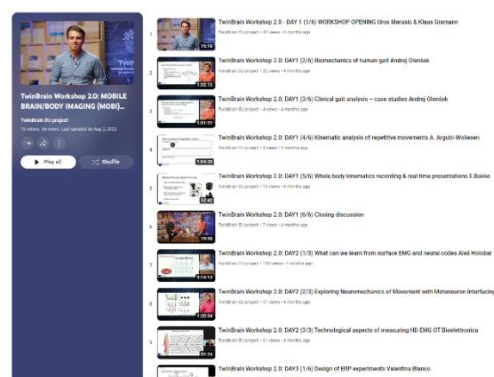


TwinBrain Workshop 2.0: Mobile Brain/Body Imaging (MoBI): from theory to clinical practice, Koper, Slovenia

The Slovenian Mobile Brain/Body Imaging lab (SloMoBIL) at ZRS Koper hosted the second TwinBrain workshop between 30 June and 2 July 2022. The workshop was streamed live allowing for interactions among participants and presenters, and provided a platform for discussion among researchers and students interested in Mobile Brain/Body Imaging (MoBI). Among the speakers were dr. Andrej Olenšek (Slovenia), dr. Andreas Argubi-Wollesen (Germany), Erik Bakke (USA), dr. Aleš Holobar (Slovenia), dr. Alessandro Del Vecchio (Germany), dr. Valentina Bianco (Italy), dr. Klaus Gramann (Germany), dr. Noelle Jacobsen (USA), dr. Fiorenzo Artoni (Switzerland), and dr. Aleksandar Miladinović (Italy).

All talks were recorded and are available on the TwinBrain YouTube channel:

➤ <https://www.youtube.com/playlist?list=PLDc8muPou6jUpWJYs1NAPMX2rKlbqcU5>



The next workshop (3.0) is planned to take place on 23-25 March 2023 in Trieste, Italy.

TwinBrain Summer School 2.0: "NEUROSCIENCE OF MOVEMENT: EXPLORING BRAIN DYNAMICS IN PARKINSON'S DISEASE AND RELATED DISORDERS", Piran, Slovenia

The "Neuroscience of Movement: Exploring brain dynamics in Parkinson's disease and related disorders" TwinBrain Summer School took place in July 2022 in Piran, Slovenia, and online. The summer school was intended for doctoral and master's students in the fields of kinesiology, physiotherapy, psychology, cognitive science, biomedical engineering, and other related sciences.

> For the TwinBrain Summer School 2.0, we have invited an international team of experts to report on the latest discoveries in the field of neuroscience on movement topics and provide insight into how brain imaging technology can contribute to the understanding of brain function and disease development. Recent advances in wireless and portable technologies allow us to go a step further in experimentation into real life or situations that reflect everyday experiences. Therefore, the latest developments in Mobile Brain/Body Imaging (MoBI) were presented by internationally recognized experts from Slovenia, Germany, Switzerland, Italy, Belgium, Czech Republic, Croatia, Bosnia and Herzegovina and the USA. Detailed information and program can be found [HERE](#).

All talks were recorded and are available on the TwinBrain YouTube channel:

https://www.youtube.com/watch?v=jtD56JA15jg&list=PLDc8muPou6jXLZ3k1LDbmj6QdA-onY6ls&ab_channel=TwinBrainEUproject

The next edition of TwinBrain Summer School will take place in June 19-24, 2023 in Piran, Slovenia.



Participants of the TwinBrain summer school 2.0

TwinBrain Round table 1.O: Koper, Slovenia

On the 15th of February 2022, a few days after the International day of women in science, a round table discussion on Women in science: A System of Equality \neq Equal Opportunities was held at the Koper Theater. Invited guests dr. Ana Rotter, prof. dr. Nadja Furlan Štante, prof. dr. Bettina Wollesen, PhD student Anna Wunderlich, prof. dr. Lenart Škof, and prof. dr. Rado Pišot talked about the extent to which the equality system also represents equal opportunities for both genders based on their own experience. They presented good practices, highlighted existing barriers, and discussed what it means to implement Gender Equality Action Plans for management and employees. The discussion was moderated by dr. Saša Pišot.

The video (only in Slovenian language) can be seen [HERE](#)



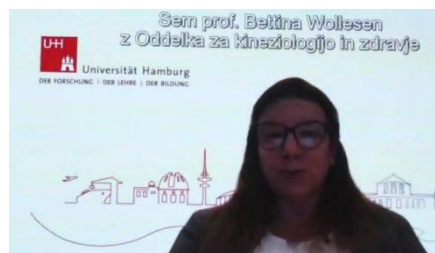
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ŽENSKE V ZNANOSTI Sistem enakosti \neq enake možnosti

15.2.2022 ob 19h v Gledališču Koper

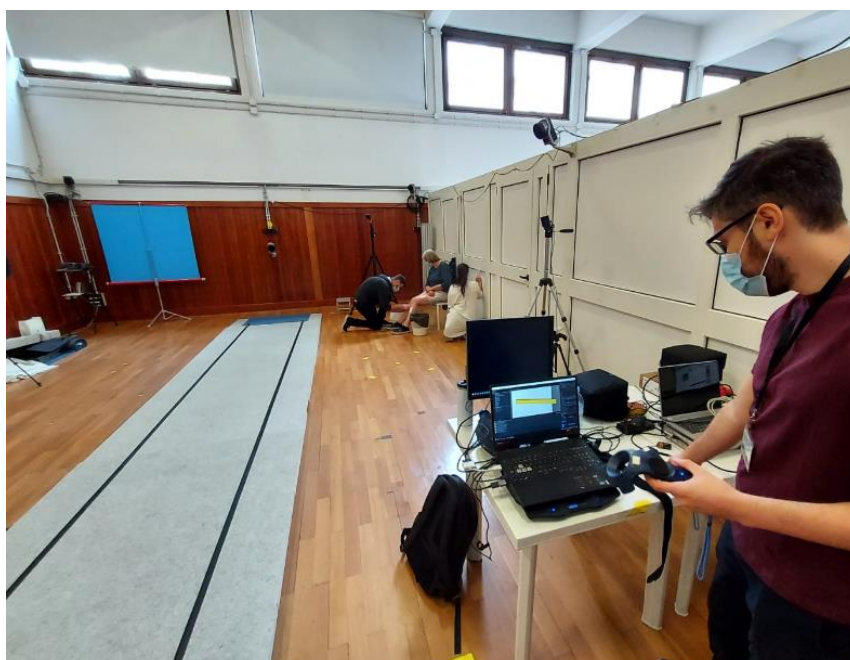


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952403.



TwinBrain Clinical trial, Trieste, Italy

In 2022 we started with the clinical trial on the implementation of Mobile Brain/Body Imaging (MoBI) on Parkinson's disease patients. The overall aim is to address the early diagnosis from neuromuscular perspective. For this reason, the TwinBrain consortium developed a highly complex system that combines hdEEG, hdEMG and whole-body kinematics. All data streams are streamed through wireless protocols.



MoBI/TwinBrain additional workshop in San Diego, USA

The 2nd TwinBrain MoBI Workshop was held in San Diego, USA, June 5-7, 2022. Several experts provided insights into the practical skills involved in designing, running, and evaluating MoBI experiments.

Workshop speakers included:

Dr. Fiorenzo Artoni (Switzerland), Sein Jeung (Germany), Marius Klug (Germany), dr. Klaus Gramann (Germany), dr. Anna Wunderlich (Germany), dr. Erika Pliner (USA), dr. Chang Liu (USA), dr. Amanda Studnicki (USA), dr. Uros Marusic (Slovenia), and dr. Martin Seeber (USA).

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MoBI 2022 Conference



MoBI 2022 Workshop

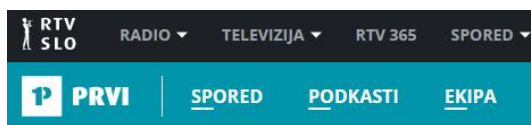


TwinBrain podcasts

Several podcasts were delivered this year. Many thanks to the contributors of this year:

- Dr. Bart Roelands [CLICK HERE](#)
- Dr. Bruno Giordani [CLICK HERE](#)
- Dr. Claudia Voelcker-Rehage [CLICK HERE](#)
- Dr. Voyko Kavcic [CLICK HERE](#)
- Dr. Uroš Marušič [CLICK HERE](#)

Podcasts are part of Slovenian national TV and Radio station:



Možgani na dlani



TwinBrain scientific publications from 2022

The year 2022 was a productive year. Below we invite you to read TwinBrain's publications (SCI, peer-reviewed articles only; listed alphabetically):

- Campos, J. L., Marusic, U., & Mahoney, J. R. (2022). Editorial: The intersection of cognitive, motor, and sensory processing in aging: Links to functional outcomes, Volume I. *Frontiers in Aging Neuroscience*, 14:1009532.
- Dillen, A., Lathouwers, E., Miladinović, A., Marusic, U., Ghaffari, F., Romain, O., ... & De Pauw, K. A data-driven machine learning approach for brain-computer interfaces targeting lower limb neuroprosthetics. *Frontiers in Human Neuroscience*, 491.
- Gorjan, D., Gramann, K., De Pauw, K., & Marusic, U. (2022). Removal of movement-induced EEG artifacts: current state of the art and guidelines. *Journal of Neural Engineering*, 19(1), 10.
- Ličen, T., Rakuša, M., Bohnen, N., Manganotti, P., & Marusic, U. Brain dynamics underlying preserved cycling ability in patients with Parkinson's disease and freezing of gait. *Frontiers in Psychology*, 3255.
- Marusic, U., Peskar, M., De Pauw, K., Omejc, N., Drevensek, G., Rojc, B., ... & Kavcic, V. (2022). Neural bases of age-related sensorimotor slowing in the upper and lower limbs. *Frontiers in Aging Neuroscience*, 14.
- Marusic, U., Verghese, J., & Mahoney, J. R. Does cognitive training improve mobility, enhance cognition, and promote neural activation?. *Frontiers in Aging Neuroscience*, 485.
- Meulenbergh, C. J., de Bruin, E. D., & Marusic, U. (2022). A perspective on implementation of technology-driven exergames for adults as telerehabilitation services. *Frontiers in Psychology*, 13.
- Šlosar, L., Voelcker-Rehage, C., Paravlič, A., Abazović, E., de Bruin, E. D., & Marušič, U. (2022). Combining physical and virtual worlds for motor-cognitive training interventions: position paper with guidelines on technology classification in movement-related research. *Frontiers in psychology*, 13(1009052), 1-8.
- Teraž, K., Šlosar, L., Paravlic, A. H., de Bruin, E. D., & Marusic, U. Impact of motor-cognitive interventions on selected gait and balance outcomes in older adults: A systematic review and meta-analysis of randomized controlled trials. *Frontiers in Psychology*, 2555.

About the TwinBrain project

The investigation of brain dynamics in most routine movements such as walking, balancing or learning new motor-cognitive tasks remains a major challenge for neuroscience. An integrative approach to investigating brain and movement dynamics was recently developed under the term MoBI: Mobile Brain/Body Imaging. This technique is based on mobile electroencephalography (EEG) synchronized to motion capture to better understand the relationship between brain dynamics, movement, and cognition in more realistic (everyday) environments. Development and optimization of this technique will provide new analytical methods for high-dimensional MoBI data in ecologically valid contexts, work with data that is not yet standard in the field of human neuroscience, and lead EEG research out of the laboratory environment into everyday situations, which become more challenging for the symptomatic population.

The overall objective of TwinBrain project is to improve the scientific and technological capacity of the country with low R&I performance (Slovenia) by twinning it with three leading international research institutions (from Germany, Switzerland, and Italy). Leading researchers in the field of neuro-muscular control, MoBI and the neuroscientific investigation of embodied cognitive processes as well as machine learning will form a network of excellence that will facilitate training and early-stage research growth through the exchange of best practices, workshops and summer schools. TwinBrain will also provide short term on-site trainings, expert visits and exchanges, as well as start working on future joint research proposals and PhD projects among partners and beyond to be continued after the completion of the project. These will lead to strengthening of long-term infrastructure capacities and facilitate the development of the proposed research area and related careers.



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